

The polyplacophoran (Eumollusca, Mollusca) fauna of the Aegean Sea with the description of a new species, and comparison with those of the neighbouring seas

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Received: 9 November 2004

Accepted after revision: 21 January 2005

Sampling carried out in the Aegean Sea revealed the presence of 14 chiton species. One new species, *Ischnochiton (Haploplax) tsekosi*, is described and another species, *Lepidopleurus (Lep-tochiton) algesirensis*, is recorded for the first time from the Eastern Mediterranean. For all species, information on their distribution and habitat is given.

A checklist of the Mediterranean and Black Sea chitons, as well as their distribution in the Mediterranean territorial areas and the Black Sea, is also presented. Furthermore, the faunas of the Mediterranean territorial areas are compared. According to the considered data, the number of species decreases as follows: Western Mediterranean, Central Mediterranean, Aegean Sea, Adriatic Sea, Levantine Sea and Black Sea. Species with an Atlanto-Mediterranean distribution dominate in all areas and are followed in numbers by the Mediterranean endemics and cosmopolitans.

Key words: Mollusca, Polyplacophora, *Ischnochiton tsekosi* n. sp., Mediterranean Sea, Aegean Sea.

INTRODUCTION

Information on the chiton fauna of the Aegean Sea is included in a limited number of papers (Leloup & Volz, 1938; Malatesta, 1962; Kattoulas *et al.*, 1973; Strack, 1988, 1990). Moreover, scattered information has also been given in a certain number of papers of wider subject (Deshayes, 1832; Forbes, 1844; Carus, 1889-1993; Bisacchi, 1928; Tortonese, 1947; Belloc, 1948; Demir, 1952-1954; Huvé, 1957; Pérès & Picard, 1958; Kisseleva, 1961, 1983; Jacquotte, 1963; Makkavieva, 1963; Geldiay & Koçatas, 1972; Vamvakas, 1972; Sabelli, 1974; Koçatas, 1976; Paget, 1976; Barash & Danin, 1977, 1988; Nordsieck, 1977; van Belle, 1978-1982; Koroneos, 1979; Kaas & van Belle, 1981, 1987; Diapoulis & Bogdanos, 1983; Koukouras *et al.*, 1985; Müller, 1985; Voultziadou-Koukoura *et al.*, 1987; Zahn & Winkelmann, 1987; Zenetos *et al.*, 1990; Barash & Zenziper, 1991). Ac-

ording to the information included in the above papers, the chiton fauna of the Aegean Sea (including the Sea of Marmara) is consisted of 16 species.

Recently, Dell'Angelo & Smriglio (2001) when revising the living chiton fauna of the Mediterranean Sea, have also recorded the presence of 16 chiton species in the Aegean Sea.

The present paper focuses on i) the new information on the chiton fauna of the Aegean Sea, ii) the comparison of the Aegean fauna with the faunas of the neighbouring seas.

MATERIALS AND METHODS

A total of more than 1,150 chiton specimens, collected from 119 stations located in the Aegean Sea (Fig. 1) was examined. Information on the characteristics of the sampling stations is given in the presentation of the species found. The samples were obtained using fishing nets, various types of dredges and grabs and by free or SCUBA diving, at depths of 0-82 m.

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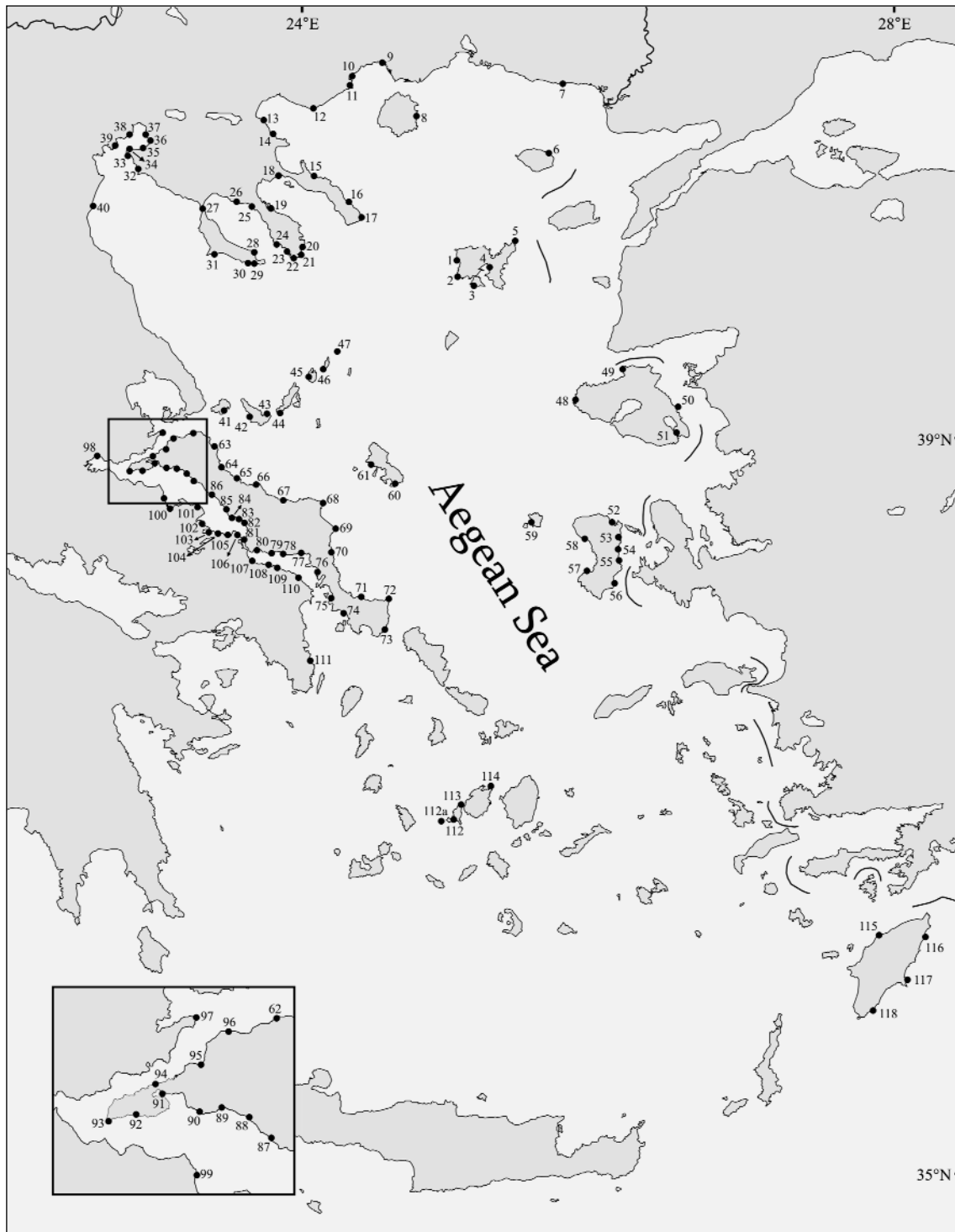


FIG. 1. Map of the Aegean Sea, indicating the sampling stations.

The specimens have been deposited at the Museum of the Department of Zoology, Aristotle University of Thessaloniki (MDZAUT).

RESULTS AND DISCUSSION

Taxonomic List

The following 14 species were found in the Aegean Sea during the present study.

Family Lepidopleuridae

Lepidopleurus (Lepidopleurus) cajetanus (Poli, 1791)

Material: 50 ♂♂, 29 ♀♀, 17 juv.; stas 2, 4, 8, 11, 14, 15, 17, 19, 20, 22, 23, 24, 28, 29, 31, 42, 50, 51, 52, 57, 59, 60, 61, 64, 77, 103, 113, and 116; depth 0.5-20 m; on rocks, calcareous algae, *Posidonia oceanica* Delile leaves and rhizome, sponges, corals; Lmax. ♂ = 22 mm, Lmax. ♀ = 23 mm.

Distribution: A species known from various areas in the Aegean Sea (Forbes, 1844; Kattoulas *et al.*, 1973; Strack, 1988).

An Atlanto-Mediterranean species (Table 1), known from all over the Mediterranean and the Atlantic regions (Malatesta, 1962; van Belle, 1978-1982; Kaas & van Belle, 1985a; Dell'Angelo & Smriglio, 2001).

Lepidopleurus (Leptochiton) algesirensis (Capellini, 1859)

Material: 1 ♀; sta. 61; depth 3 m; on a stone; L = 3 mm.

Distribution: This species was reported for the first time from the Eastern Mediterranean (Aegean Sea and Levantine Basin). Also not known from the Adriatic Sea.

An Atlanto-Mediterranean species (Table 1), known from certain areas of the Western Mediterranean (Capellini, 1859; Carus, 1889-1893; Leloup, 1980; van Belle, 1978-1982; Terreni, 1983; Kaas & van Belle, 1985a), the Central Mediterranean (Carus, 1889-1893; Thake & Schembri, 1978; Kaas & van Belle, 1985a) and the NE Atlantic region (van Belle, 1978-1982; Kaas & van Belle, 1985a).

Lepidopleurus (Leptochiton) cancellatus (Sowerby, 1840)

Material: 6 ♂♂, 4 ♀♀; stas 9, 10 and 11; depth 17.5-34 m; on stones; Lmax. ♂ = 5 mm, Lmax. ♀ = 5 mm.

Distribution: This species has been known in the Aegean Sea only from the Cyclades Islands (Strack, 1990).

Atlanto-Mediterranean species (Table 1), known from certain areas of the Western Mediterranean (Sabeli, 1974; van Belle, 1978-1982; Altimira, 1980; Bogi *et al.*, 1980; Templado, 1984; Tringali & Rugeri, 1995), the Central Mediterranean (Thake & Schembri, 1978; Panetta *et al.*, 1985; Kaas, 1989), the Adriatic (Zavodnic, 1971; Sabeli, 1974; Taviani, 1980; Bello *et al.*, 1982; Terreni, 1983), the Levantine Basin, Cyprus (Demetropoulos, 1971; Barash & Da-

nin, 1977) and the Atlantic coast (van Belle, 1978-1982; Kaas & van Belle, 1985a).

Lepidopleurus (Leptochiton) scabridus (Jeffreys, 1880)

Material: 5 ♂♂, 1 ♀; stas 9, 22, 23, 29 and 113; depth 1-12 m; on stones and calcareous algae; Lmax. ♂ = 4.5 mm, L ♀ = 4 mm.

Distribution: It has been recorded in this area only from the Saronikos Gulf, the Santorini Island (Strack, 1988), and the Athos Peninsula (Baschieri, 1994).

Atlanto-Mediterranean species (Table 1), known in the Western Mediterranean from the Tuscan Archipelago (Bogi *et al.*, 1980; Dell'Angelo & Palazzi, 1986), in the Central Mediterranean from the Malta Island (Mifsud *et al.*, 1990), Taranto Gulf (Dell'Angelo & Palazzi, 1986; Baschieri, 1994) and the Sicily coast (Dell'Angelo & Palazzi, 1986), in the Adriatic from the Istria Island (Dell'Angelo & Palazzi, 1986) and the Otranto coast (Baschieri, 1994). Also known in the Atlantic coast from the Biscay Gulf, the English Channel (van Belle, 1978-1982; Dell'Angelo & Palazzi, 1986) and the Irish coast (Strack, 1991).

Family Ischnochitonidae

Ischnochiton (Haploplax) tsekosi n. sp. (Figs 2-4)

Type material: Holotype: 2.8 × 1.6 mm (excluding girdle); Moni Iviron, Mountain Athos at Chalkidiki Peninsula (sta. 16), Aegean Sea; 3.5 m depth; on the sponge *Aplysina aerophoba* Schmidt; 19. viii. 1975, A. Koukouras, collector; MDZAUT G1 5264 – Paratype: 3.9 × 2.2 mm (excluding girdle); Porto Koufo, Chalkidiki Peninsula (sta. 22), Aegean Sea; 4.5 m depth; on the sponge *Aplysina aerophoba* Schmidt; 3. viii. 1975, A. Koukouras, collector; MDZAUT G1 5265 (only on photographs, since specimen was lost after its study).

Etymology: It is our pleasure to name this species after Prof. Ioannis Tsekos (Institute of Botany, Aristotle University of Thessaloniki) who has contributed so much to the progress of education and science.

Diagnosis: Animal of small size, oval, rather flat, dorsal ridge almost rounded. Valves very thin, translucent, not beaked, lateral areas not evident. Tegmentum uniformly finely granulose. Perinotum large, dorsally covered with imbricating, practically smooth, concaved scales.

Description: Animal of small size, holotype 2.8 ×

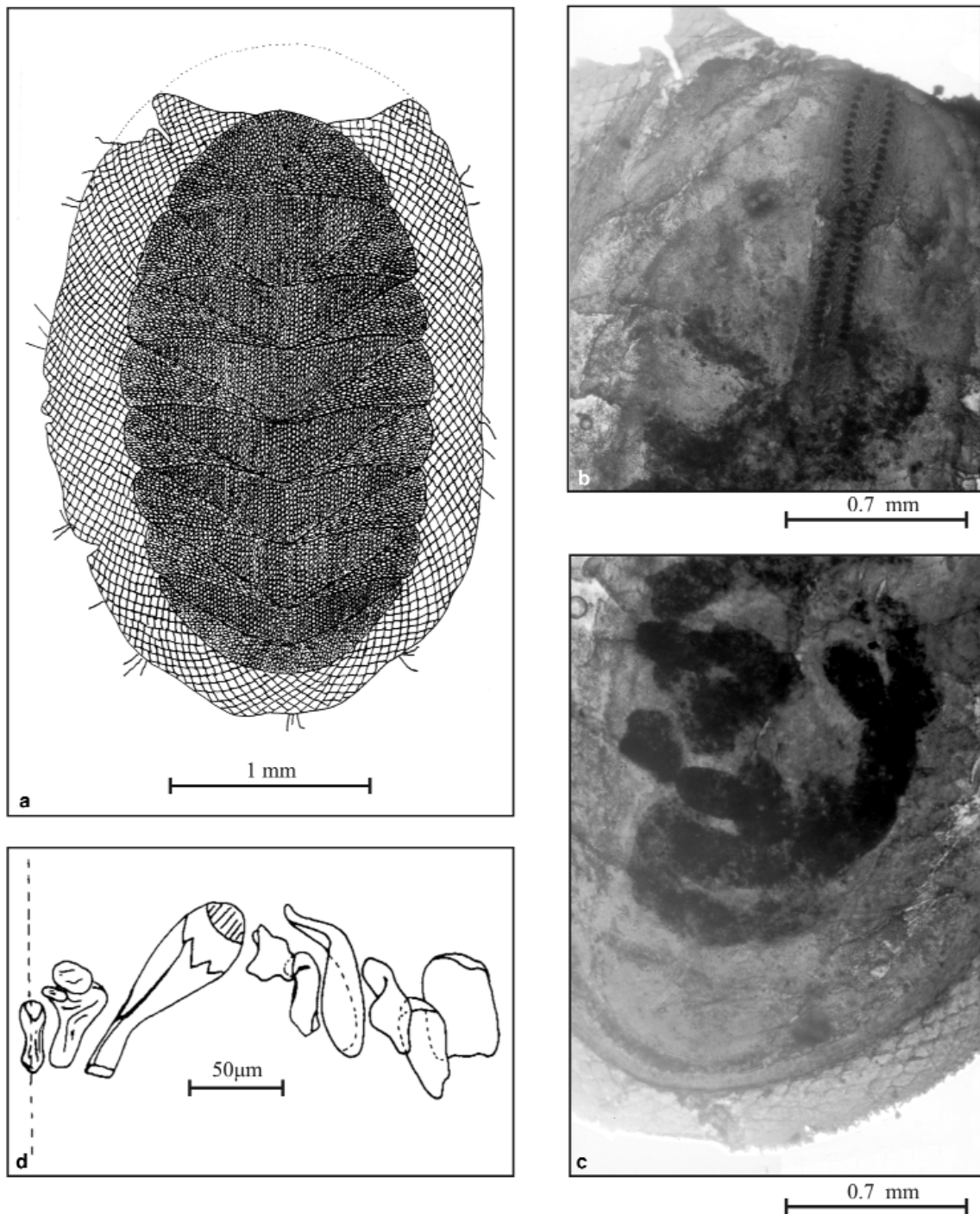


FIG. 2. *Ischnochiton (Haploplax) tsekosi* n. sp., holotype. a, whole specimen, dorsal view; b, detail of the anterior part, dorsal view, with the radula evident; c, detail of the posterior part, dorsal view; d, half transverse row of radula.

1.6 mm, paratype 3.9×2.2 mm (excluding girdle), oval, rather flat, dorsal ridge almost rounded, valves not beaked. Colour of tegmentum uniformly yellowish.

Head valve semicircular, posterior margin forming a very obtuse angle, almost straight, not notched in the middle, tegmentum microgranulose, granules

weak, arranged in forwardly radiating rows, giving to the tegmentum a minutely reticulated appearance. Intermediate valves with side margins slightly rounded, anterior margin weakly concave (except for valve II, where it is convex), posterior margin weakly concave at both sides of the more or less protruding apex, lateral areas not evident, granules arranged as

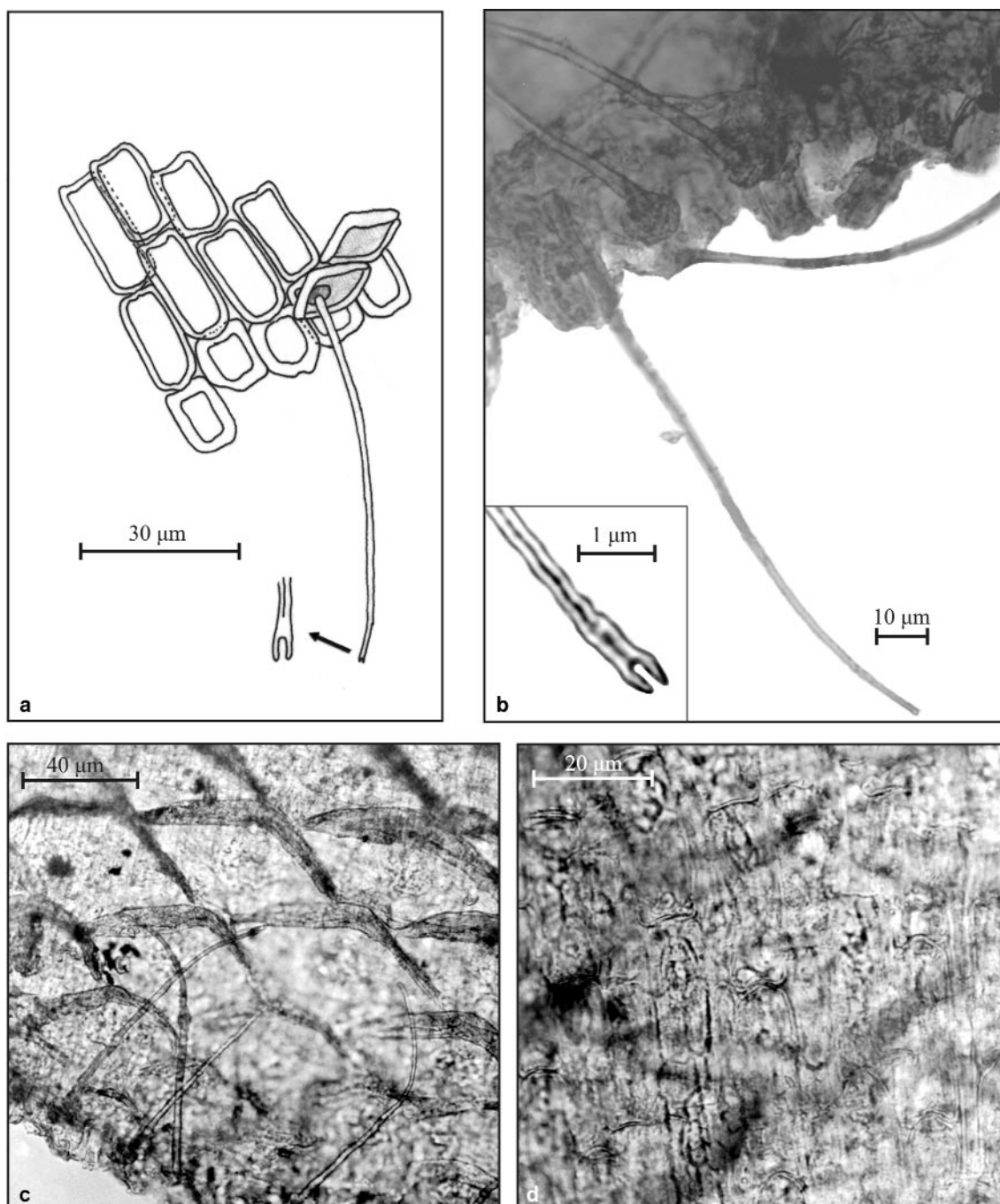


FIG. 3. *Ischochiton (Haploplax) tsekosi* n. sp., holotype. a, marginal dorsal and ventral scales, dorsal view, with a seta; b, details of the marginal part and of a seta, dorsal view; c, perinotum, dorsal scales; d, perinotum, ventral scales.

in head valve. Tail valve semicircular, with anterior margin similar to that of the intermediate valves, somewhat more wide and less elongated than head valve, the width more than three times the length, mucro almost median, not prominent, granules arranged as in head valve.

Articulamentum not indicated (except for head valve, where 6 slits indicated).

Perinotum wide, transparent, dorsally covered with imbricating, rhomboidal, practically smooth scales, measuring about $85 \times 50 \mu\text{m}$, getting smaller near the outer and, more clearly, near the inner margin; dorsally round-topped, having outer half lowered, the base also rhomboidal. Marginal dorsal scales bearing solitary, bifurcate at the end setae (1–200 μm long), rising from a chitinous cup. Marginal

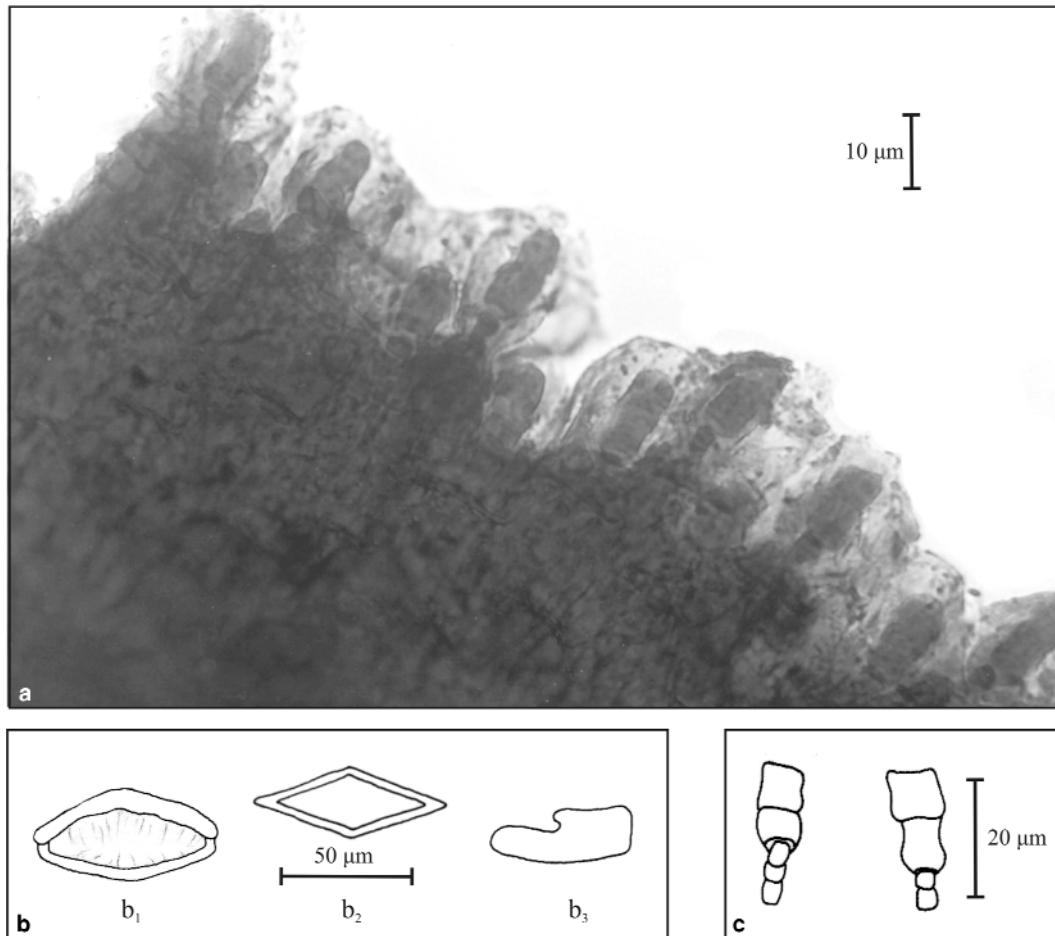


FIG. 4. *Ischnochiton (Haploplax) tsekosi* n.sp., holotype. a, perinotum, detail of marginal fringe, dorsal view; b, dorsal scales: (b₁) dorsal view, (b₂) ventral view, (b₃) antero-lateral view; c, marginal spicules.

fringe composed of stalked, articulate, calcareous, blunt-topped spatulate spicules, all of about equal size. Ventral side of perinotum paved with radiating, partly overlapping rows of emarginated, hyaline, rectangular (about $25 \times 10 \mu\text{m}$) scales, getting more squarish (about $15 \times 10 \mu\text{m}$) near the outer margin.

Radula comprised of about 30 rows of mature teeth, rachidian tooth of radula bulbous at the base, pinched in the middle, distally widening to a convex triangular blade; first lateral tooth irregularly trapezoidal, slender at the base, with a bifid protuberance at the anterolateral corner, no blade; major lateral tooth with a tricuspid dental cup, denticles pointed, the central one somewhat longer than the others.

Discussion: *Ischnochiton tsekosi* n. sp. is clearly distinguished from the seven European congeners mainly on the basis of its dorsal perinotum scales (Dell'Angelo & Castriota, 1999; Dell'Angelo & Smriglio, 2001). It is also distinguished from its other congeners by other essential differences given by

Kaas & van Belle (1990, 1994).

According to the key given by Kaas & van Belle (1990), this species belongs to the subgenus *Haploplax*, having Indo-Pacific distribution (Kaas & van Belle, 1994). The presence of *I. tsekosi* n. sp. in the Eastern Mediterranean is the first record of the subgenus *Haploplax* in such a longitude. It is possibly an endemic species of the Mediterranean Sea, associated with the sponge *Aplysina aerophoba* Schmidt.

Ischnochiton (Ischnochiton) rissoi (Payraudeau, 1836)

Material: 38 ♂♂, 10 ♀♀ (1 ♀, bearing mature ova), 4 juv.; stas 1, 14, 22, 27, 28, 34, 42, 51, 53, 54, 55, 56, 58, 59, 61, 75, 79, 81, 105, 112, 113, 116, and 118; depth 0.2-20 m; on rocks, stones and shells; Lmax. ♂ = 24.5 mm, Lmax. ♀ = 24 mm.

Distribution: Known from many localities in the Aegean (Forbes, 1844; Kattoulas et al., 1973; van Belle, 1978-1982; Strack, 1988, 1990).

An Atlanto-Mediterranean species (Table 1), known all over the Mediterranean (Kaas & van Belle, 1987; Dell'Angelo & Smriglio, 2001), and the Atlantic (surroundings of Gibraltar, Canary Islands, Azores Islands) (Leloup, 1934; Dell'Angelo & Smriglio, 2001).

Callochiton septemvalvis (Montagu, 1803)

Material: 4 ♂♂, 8 ♀♀, 15 juv.; stas 16, 23, 45, 47, 62, 75, 103, and 112a; depth 0.5-72.8 m; on rocks, calcareous algae, and shells of *Bolinus brandaris* (Linnaeus); Lmax. ♂ = 8 mm, Lmax. ♀ = 15 mm.

Distribution: Known from several areas in the Aegean (Forbes, 1844; Kattoulas *et al.*, 1973; Strack, 1988, 1990).

An Atlanto-Mediterranean species (Table 1), known from all over the Mediterranean and the Atlantic regions (Kaas & van Belle, 1985b). The record of this species in the Gulf of Aqaba, Red Sea (Leloup, 1980), according to Strack (1993) belongs to the species *Callochiton vanninii* Ferreira.

Lepidochitona (Lepidochitona) caprearum (Scacchi, 1836)

Material: 1 ♂, 2 ♀♀; sta. 116; depth 0.1 m; on rocks; L ♂ = 10 mm, Lmax. ♀ = 9 mm.

Distribution: Known from several areas in the Aegean (Forbes, 1844; Huvé, 1957; Barash & Danin, 1977; Strack, 1988).

An Atlanto-Mediterranean species (Table 1), known from all over the Mediterranean (Taviani, 1978; Barash & Danin, 1992; Kaas & van Belle, 1985b; Kaas, 1989; Dell'Angelo & Smriglio, 2001). Also known from the Sea of Marmara (Müller, 1985), the Varna Gulf, Black Sea (Paspaleff, 1933), and from the NE Atlantic region (Kaas, 1991). However, its records from the Red Sea are referable to *Lepidochitona monterosatoi* Kaas & van Belle (Strack, 1993).

Lepidochitona (Lepidochitona) cinerea (Linnaeus, 1767)

Material: 66 ♂♂, 60 ♀♀, 17 juv.; stas 14, 27, 34, 36, 37, 38, 39, and 103; depth 0.5-8 m; on rocks and stones; Lmax. ♂ = 11 mm, Lmax. ♀ = 10 mm.

Distribution: Known from certain areas in the Aegean, including the Sea of Marmara, but also from the Black Sea (Bacescu *et al.*, 1971; van Belle, 1978-1982; Kaas & van Belle, 1981; Strack, 1988).

A cosmopolitan species (Table 1), known from all over the Mediterranean, the Atlantic region and the

North American Pacific coast (van Belle, 1978-1982; Kaas & van Belle, 1981, 1985b; Dell'Angelo & Smriglio, 2001).

Lepidochitona (Lepidochitona) monterosatoi Kaas & van Belle, 1981

Material: 37 ♂♂, 35 ♀♀ (1 ♀, bearing mature ova), 11 juv.; stas 14, 23, 27, 28, 31, 38 and 103; depth 0.5-12 m; on rocks, calcareous algae, *Posidonia oceanica* and sponges; 50 of the specimens were found in station 38 (an area at the Gulf of Thessaloniki, organically polluted), where depth was 2.2 m, substrate temperature 22.3°C and salinity 31‰; Lmax. ♂ = 12.5 mm, Lmax. ♀ = 11 mm.

Distribution: It has been known in the Aegean only from the SW Turkish coast, Torbo (Kaas & van Belle, 1981), the Cyclades Islands (Strack, 1988, 1990) and the Chalkidiki Peninsula (Strack, 1990).

A Mediterranean endemic species (Table 1), known from certain areas of the Western Mediterranean (Kaas & van Belle, 1981; van Belle, 1978-1982; Biondi *et al.*, 1983; Dell'Angelo & Palazzi, 1983; Terreni, 1983; Bogi *et al.*, 1986), the Gulf of Gabès in the Central Mediterranean (Kaas, 1989), and the Adriatic (Strack, 1982). Strack (1993) reported the presence of this species in the Red Sea, the Museri Island, Ethiopian coast, and documented that the specimens from the Red Sea coast of Israel, identified as *Lepidochitona corrugata* by Leloup (1980), belong to the species *L. monterosatoi*. Thus, he considered this species an Antillessepsian migrant.

Family Chitonidae

Chiton (Rhyssoplax) corallinus (Risso, 1826)

Material: 6 ♂♂, 5 ♀♀ (1 ♀, bearing mature ova), 2 juv.; stas 4, 13, 23, 30, 35, 36, 45, 103, 112, 112a, and 113; depth 0.5-82 m; on rocks, stones, calcareous algae and shells (*Pinna nobilis*, Linnaeus); Lmax. ♂ = 12.5 mm, Lmax. ♀ = 14 mm.

Distribution: It has been known in the North Aegean from Chalkidiki Peninsula (Strack, 1990) and in the south Aegean from several areas (Forbes, 1844; Vamvakas, 1972; Strack, 1988, 1990; Zenetos *et al.*, 1992).

A Mediterranean endemic species (Table 1), known from all over the Mediterranean (van Belle, 1978-1982; Kaas, 1989; Dell'Angelo & Smriglio, 2001). The Red Sea records by Leloup (1960, 1980) have been attributed by Strack (1993) to *Chiton (Rhyssoplax) maldivensis* (Smith).

TABLE 1. Check list of the Mediterranean Polyplacophora and their distribution in certain geographical areas of the Mediterranean and the Black Sea, with reference to their presence in the Atlantic and Indo-Pacific Oceans. WM = Western Mediterranean, CM = Central Mediterranean, AD = Adriatic Sea, LB = Levantine Basin, AS = Aegean Sea (including the Sea of Marmara), BS = Black Sea, AO = Atlantic Ocean, IP = Indo-Pacific Ocean (Red Sea). Zoogeographical characterisation (ZC): AM, Atlanto-Mediterranean; C, Cosmopolitan species; E, Possibly endemic species; LM, Lessepsian migrants. VD = Vertical distribution. Species marked with * were found in the present study. Species marked with + are reported for the first time from the Eastern Mediterranean (Aegean Sea and Levantine Basin)

Mediterranean species		WM	CM	AD	AS	LB	BS	AO	IP	ZC	VD (m)
Lepidopleuridae											
	* <i>Lepidopleurus (Lepidopleurus) cajetanus</i> (Poli, 1791)	+	+	+	+	+		+		AM	0.5-40
+	* <i>Lepidopleurus (Leptochiton) algeriensis</i> (Capellini, 1859)	+	+		+			+		AM	1-5
	<i>Lepidopleurus (Leptochiton) asellus</i> (Gmelin, 1791)	+						+		AM	0-450
	* <i>Lepidopleurus (Leptochiton) bedulli</i> (Dell'Angelo & Palazzi, 1986)	+	+	+	+	+		+		E	10-60
	* <i>Lepidopleurus (Leptochiton) cancellatus</i> (Sowerby, 1840)	+	+	+	+	+		+		AM	0-550
	<i>Lepidopleurus (Leptochiton) cimicoides</i> (Monterosato, 1879)	+	+	+				+		AM	20-110
	<i>Lepidopleurus (Leptochiton) geronensis</i> (Kaas & van Belle, 1985)	+	+	+	+			+		E	100-250
	* <i>Lepidopleurus (Leptochiton) scabridus</i> (Jeffreys, 1880)	+	+	+	+			+		AM	0.2-12
	<i>Lepidopleurus (Leptochiton) xanthus</i> (Kaas & van Belle, 1990)	+	+	+	+			+		AM	250-1108
	<i>Lepidopleurus (Parachiton) africanus</i> Nierstrasz, 1906	+	+	+	+			+		E	1.5-150
Hanleyidae											
	<i>Hanleya hanleyi</i> (Bean in Thorpe, 1844)	+	+	+	+			+	+	C	15-500
Bathychitonidae											
	<i>Bathychiton biondii</i> Dell'Angelo & Palazzi, 1988	+						+		AM	250-1378
Ischnochitonidae											
	<i>Callistochiton (Allerychiton) pachyplasmae</i> (Monterosato, 1879)	+	+		+			+		AM	33-500
	<i>Callochiton calcatus</i> Dell'Angelo & Palazzi, 1994	+	+					+		E	30-100
	* <i>Callochiton septemvalvis</i> (Montagu, 1803)	+	+	+	+	+		+		AM	0.2-500
	<i>Chaetopleura (Chaetopleura) angulata</i> (Spengler, 1797)	+						+		AM	0-50
+	* <i>Ischnochiton (Haploplax) tsekosi</i> n. sp.				+					E	3.5-5
	* <i>Ischnochiton (Ischnochiton) rissoi</i> (Payraudeau, 1826)	+	+	+	+	+		+		AM	1-100
	<i>Ischnochiton (Ischnochiton) usticensis</i> Dell'Angelo & Castriota, 1999	+								E	50
	<i>Ischnochiton (Stenosemus) doli</i> van Belle & Dell'Angelo, 1998	+								E	350-560
	<i>Ischnochiton (Stenosemus) vanbellet</i> Kaas, 1985	+	+					+		AM	30-550
	<i>Lepidochitona (Lepidochitona) canariensis</i> (Thiele, 1909)	+						+		AM	0-0.5
	* <i>Lepidochitona (Lepidochitona) caprearum</i> (Scacchi, 1836)	+	+	+	+	+	+	+		AM	0-70
	* <i>Lepidochitona (Lepidochitona) cinerea</i> (Linnaeus, 1767)	+	+	+	+	+	+	+	+	C	0-130
	<i>Lepidochitona (Lepidochitona) furiva</i> (Monterosato, 1879)	+	+	+	+	+				E	1-40
	* <i>Lepidochitona (Lepidochitona) monterosatoi</i> Kaas & van Belle, 1981	+	+	+	+	+				E	0.5-40

cont.

TABLE 1 (cont). Check list of the Mediterranean Polyplacophora and their distribution in certain geographical areas of the Mediterranean and the Black Sea, with reference to their presence in the Atlantic and Indo-Pacific Oceans. WM = Western Mediterranean, CM = Central Mediterranean, AD = Adriatic Sea, LB = Levantine Basin, AS = Aegean Sea (including the Sea of Marmara), BS = Black Sea, AO = Atlantic Ocean, IP = Indo-Pacific Ocean (Red Sea). Zoogeographical characterisation (ZC): AM, Atlanto-Mediterranean; C, Cosmopolitan species; E, Possibly endemic species; LM, Lessepsian migrants; VD = Vertical distribution. Species marked with * were found in the present study. Species marked with + are reported for the first time from the Eastern Mediterranean (Aegean Sea and Levantine Basin)

Mediterranean species	WM	CM	AD	AS	LB	BS	AO	IP	ZC	VD (m)
Chitonidae										
* <i>Chiton (Rhyssoplax) corallinus</i> (Risso, 1826)	+	+	+	+	+				E	0-100
* <i>Chiton (Rhyssoplax) olivaceus</i> Spengler, 1797	+	+	+	+	+		+		AM	0-62
<i>Chiton (Rhyssoplax) phaeolinus</i> Monterosato, 1879	+	+			+				E	1-5
<i>Chiton (Tegulaplex) hululensis</i> (E.A. Smith in Gardiner, 1903)					+			+	LM	0-20
Acanthochitonidae										
* <i>Acanthochitona crinita</i> (Pennant, 1777)	+	+	+	+	+		+		AM	0-175
* <i>Acanthochitona fascicularis</i> (Linnaeus, 1767)	+	+	+	+	+		+	+	C	0-73
Total number of species: 32	30	23	15	18	13	3				

Chiton (Rhyssoplax) olivaceus Spengler, 1797

Material: 285 ♂♂, 150 ♀♀ (4 ♀♀, bearing mature ova), 26 juv.; stas 1, 3, 4, 5, 6, 7, 8, 11, 12, 13, 14, 15, 17, 21, 22, 23, 25, 26, 27, 28, 30, 34, 40, 41, 42, 43, 44, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 63, 64, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 77, 78, 80, 81, 82, 84, 85, 86, 87, 88, 89, 91, 92, 94, 95, 96, 97, 98, 99, 101, 102, 103, 104, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117 and 118; depth 0.5-62 m; on rocks, stones, calcareous algae, sponges, anthozoans (*Eunicella singularis* Esper), and shells; Lmax. ♂ = 34 mm, Lmax. ♀ = 26.5 mm.

Distribution: Very common all over the Aegean (Forbes, 1844; Kattoulas *et al.*, 1973; Strack, 1988, 1990).

An Atlanto-Mediterranean species (Table 1), commonly occurring in the Mediterranean (Carus, 1889-1893; van Belle, 1978-1982; Kaas, 1989; Dell'Angelo & Smriglio, 2001). Its distribution has been extended to the Atlantic area only as far as Tangiers and southern Portugal.

Family Acanthochitonidae

Acanthochitona crinita (Pennant, 1777)

Material: 11 ♂♂, 8 ♀♀ (1 ♀, bearing mature ova), 9 juv.; stas 23, 81, 83, 103 and 118; depth 0.5-12 m; on rocks, stones and calcareous algae; Lmax. ♂ = 15 mm, Lmax. ♀ = 10 mm.

Distribution: It has been known from several areas of the Aegean Sea as *A. fascicularis* (Kattoulas *et al.*, 1973; Koukouras *et al.*, 1985; Voultziadou-Koukoura *et al.*, 1987) and as *A. crinita* (Strack, 1988, 1990).

An Atlanto-Mediterranean species (Table 1), known from several areas all over the Mediterranean and the Atlantic, from Norway south to the Cape Verde Archipelago, Azores and Canary Islands, North American coast, Madeira and Brazil (Kaas, 1985; Dell'Angelo & Smriglio, 2001).

Acanthochitona fascicularis (Linnaeus, 1767)

Material: 116 ♂♂, 34 ♀♀ (1 ♀, bearing mature ova), 59 juv.; stas 3, 4, 5, 8, 10, 11, 12, 13, 14, 17, 18, 22, 23, 27, 28, 30, 32, 33, 40, 42, 45, 46, 47, 49, 51, 56, 61, 65, 68, 74, 75, 76, 77, 79, 81, 85, 86, 90, 93, 100, 103, 106, 112, 112a, 113 and 117; depth 0-72.8 m; on rocks, stones and calcareous algae, sponges, anthozoans (*Cladocora caespitosa* Linnaeus, *Eunicella singularis* Esper), shells and polychaete tubes; Lmax. ♂ = 26 mm, Lmax. ♀ = 28 mm.

Distribution: Very common all over the Aegean

(Forbes, 1844; Demir, 1952-1954; Kattoulas *et al.*, 1973 as *A. communis*; Strack, 1988, 1990).

A cosmopolitan species (Table 1), known all over the Mediterranean (van Belle, 1978-1982; Kaas, 1985, 1989) the Black Sea (Bacescu *et al.*, 1971; Müller, 1973), the Atlantic (from the British Channel to the Azores, and the Canary Islands and the Caribbean), the Antarctic Ocean and Australia (e.g., van Belle, 1978-1982; Dell'Angelo & Smriglio, 2001).

Four more chiton species are known from the Aegean Sea (Table 1): *Lepidopleurus (Leptochiton) bedullii* (Dell'Angelo & Palazzi, 1986) (Dell'Angelo & Palazzi, 1986; Strack, 1988, 1990); *Lepidopleurus (Parachiton) africanus* Nierstrasz, 1906 (Kaas & van Belle, 1987; Strack, 1990); *Hanleya hanleyi* (Bean in Thorpe, 1844) (Kisseleva, 1983; Strack, 1990); *Callistochiton (Allerychiton) pachylasmae* (Monterosato, 1879) (Dell'Angelo & Oliverio, 1997; Dell'Angelo & Smriglio 2001).

Comparison of the Aegean Fauna with the faunas of the neighbouring seas

Piani (1980-1983), based on literature information, numbered 22 Mediterranean chiton species. Dell'Angelo & Smriglio (2001) revising the living chiton fauna of the Mediterranean Sea recorded the pres-

ence of 31 species.

The review of the relevant literature showed that, up to date, 31 valid species have been known from the Mediterranean. Their distribution over the geographical areas of the Mediterranean and their presence in the Black and Red Seas, and the Atlantic Ocean, as well as their depth range according to literature, are given in Table 1. The new species *Ischnochiton (Haploplax) tsekosi* raises this number to 32. The distribution of the known chiton species in the main geographical areas of the Mediterranean Sea and the Black Sea (as real numbers and percentages of the total Mediterranean species) resulting from this study is given in Fig. 5. Taking into account Fig. 1, Table 1, data on the Mediterranean water masses and circulation (Ovchinnikov, 1966; The POEM group, 1992; Perivoliotis *et al.*, 1997) together with data on temperature and salinity variations (Lacombe *et al.*, 1958; Özsoy *et al.*, 1993) and geographical aspects (Bianchi & Morri, 2000; Pinardi & Masetti, 2000), the following considerations can be made:

Western Mediterranean (WM): 30 species, 93.75% of the known Mediterranean fauna (Di Monterosato, 1881, 1890; Bellini, 1929; Leloup, 1934, 1960, 1980; Paulus & Mars, 1941; Sabeli, 1974; Altimira,

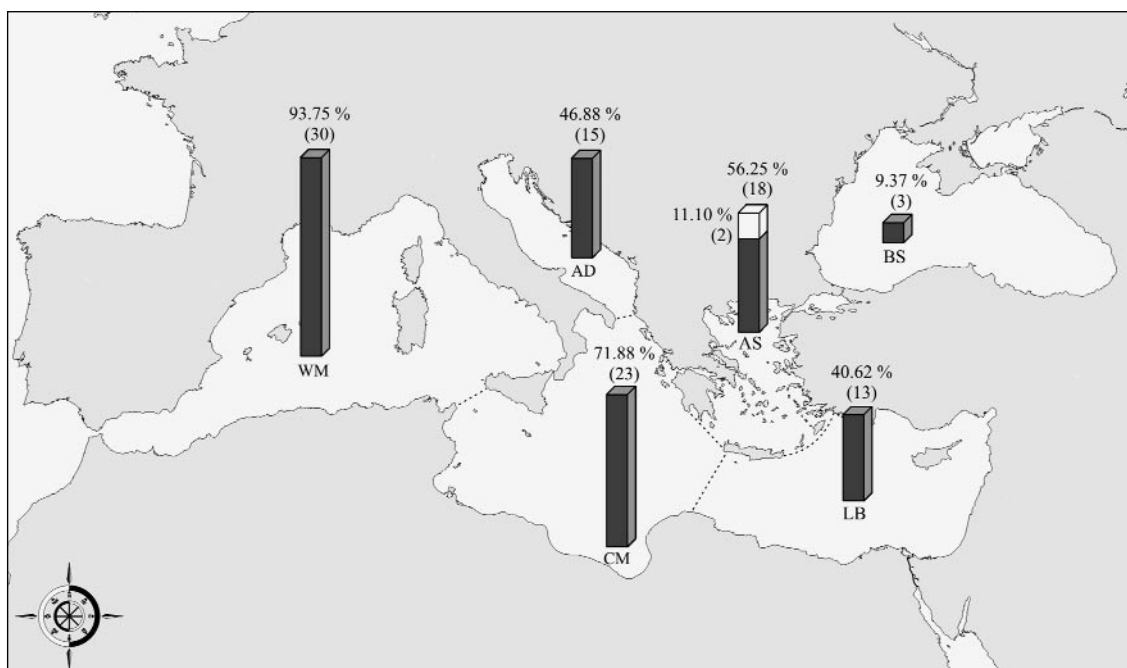


FIG. 5. Distribution of the known species of chitons in the main geographical areas of the Mediterranean and the Black Seas, as real numbers and percentages of the total Mediterranean species. The blanc part of the column concerning the Aegean Sea shows the number of species added by the present study (Abbreviations as in Table 1).

1976, 1977, 1980; Bogi *et al.*, 1980; van Belle, 1978-1982; Kaas & van Belle, 1981; Dell'Angelo & Palazzi, 1983, 1986; Terreni, 1983; Dexter, 1992; Dell'Angelo & Smriglio, 2001). In the Western Mediterranean, apart from the new species, only *Chiton (Tegulaplex) hululensis* has not been found; this species has an Indo-Pacific origin and is considered a Lessepsian migrant (Table 1). The highest diversity of chiton fauna in the western basin of Mediterranean (Fig. 5) could be attributed to the fact that the influx of Atlantic species is initially limited in this large basin, which having a wide range of physico-chemical parameters permits the settlement of both cold and warm water species in its northern and southern parts respectively; this general trend does not seem to be strongly based on the more intensive sampling carried out in this area.

Central Mediterranean (CM): 23 species, 71.88% of the known Mediterranean fauna (Leloup, 1960, 1980, 1981; Thake & Schrembri, 1978; van Belle, 1978-1982; Kaas & van Belle, 1981; Macri, 1981; Dell'Angelo & Cuppini, 1983; Dell'Angelo & Palazzi, 1986; Strack, 1988; Kaas, 1989; Misfud *et al.*, 1990; Baschieri, 1994; Dell'Angelo & Smriglio, 2001). Central Mediterranean comes second in chiton diversity (Table 1). This can mainly be attributed to its direct neighbouring with the Western Mediterranean, as well as to the satisfactory sampling effort.

Adriatic Sea (AD): 15 species, 46.88% of the known Mediterranean fauna (Coen, 1914; Leloup, 1934, 1960, 1980; Zavodnic, 1971; van Belle, 1978-1982; Taviani, 1980; Bello *et al.*, 1982; Strack, 1982; Ruggiero, 1983; Dell'Angelo & Palazzi, 1986; Baschieri, 1994; Dell'Angelo & Smriglio, 2001). The Adriatic (Table 1), although intensively sampled, displays a relatively low diversity. This must mainly be attributed to: (a) its considerably restricted communication with the western basin (Ovchinnikov, 1966; Theocharis *et al.*, 1993), (b) the smaller amplitude of temperature variations (Delepine *et al.*, 1987), (c) the shallow waters of its northern part with relatively low winter temperatures and low salinity (Lacombe & Tchernia, 1960).

Aegean Sea (AS): 18 species, 56.25% of the known Mediterranean fauna (Forbes, 1844; Demir, 1952-1954; Huvé, 1957; Pérès & Picard, 1958; Malatesta, 1962; Vamvakas, 1972; Kattoulas *et al.*, 1973; Paget, 1976; van Belle, 1978-1982; Kaas & van Belle, 1981; Koukouras *et al.*, 1985; Voultziadou-Koukoura *et al.*, 1987; Strack, 1988, 1990; Zenetos *et al.*, 1992; Baschieri, 1994; Dell'Angelo & Smriglio, 2001; pre-

sent study). Although the Aegean Sea is more distant from Gibraltar (the main pathway of enrichment for the Mediterranean fauna) than the Adriatic and no intensive sampling effort, targeted to this taxon has been carried out deeper than 80 m, the Aegean is inhabited by a larger number of species (Table 1). Furthermore, the Adriatic has been studied for much longer. The main reasons for the higher species number in the Aegean may be: (a) its more direct communication with the western basin (Ovchinnikov, 1996) and (b) the greater amplitude of the temperature variations (Delépine *et al.*, 1987).

Levantine Basin (LB): 13 species, 40.62% of the known Mediterranean fauna (Forbes, 1842; Leloup, 1960, 1969, 1980; Demetropoulos, 1969, 1971; Barash & Danin, 1977; van Belle, 1978-1982; Strack, 1988; Buzzuro & Greppi, 1996). The lowest species diversity of the Levantine Basin in comparison with those of other Mediterranean areas (Fig. 5) should be mainly attributed to its impoverished fauna (Por & Dimentman, 1989; Koukouras & Russo, 1991; Koukouras *et al.*, 2001; Arvanitidis *et al.*, 2002), as well as to the less intensive sampling effort carried out in the area.

Black Sea (BS): 3 species, 9.37% of the known Mediterranean fauna (Paspaleff, 1933; Malatesta, 1962; Bacescu *et al.*, 1971; Müller, 1973; van Belle, 1978-1982; Kaas & van Belle, 1981). The extremely low diversity of the Black Sea fauna is a result of the very peculiar oceanographic conditions prevailing in the area, especially the low salinities and temperatures (Caspers, 1957; Longhurst, 1998). This is especially true in the case of chitons since almost all species are stenopolyhaline (Kaas & van Belle, 1985 a, b).

In Fig. 6 (based on Table 1) the participation of the four zoogeographical categories as percentages of the total Mediterranean species is shown. As is demonstrated, most species (53.12%) have an Atlanto-Mediterranean distribution, while 34.38% (11 species) are possibly Mediterranean endemics and only 3 species (9.38%) are cosmopolitan. One species (3.12%) is a Lessepsian immigrant in the Mediterranean Sea. The percentage of endemic species is relatively very high, probably due to the sluggish locomotion of chitons and their relative short pelagic stage of development (Kaas & van Belle, 1985a, b).

In Fig. 7 (based also on Table 1), the percentages of the four zoogeographical categories, for the total of species known from each Mediterranean area and the Black Sea, are shown. From this figure it is ob-

vious that in each Mediterranean area, Atlanto-Mediterranean species dominate followed by endemic and cosmopolitan species. Furthermore, the species number (and percentage) of each zoogeographical category seems to decline from west to

east, as it also applies to the total known species numbers from each Mediterranean area. The above considerations are supported by those of Koukouras *et al.* (2001).

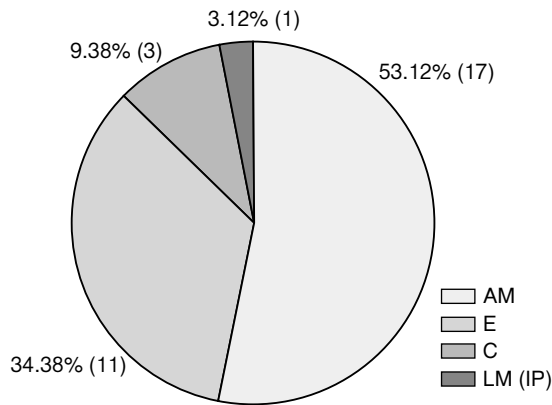


FIG. 6. Chiton fauna composition in the Mediterranean and Black Seas (percentages and real numbers), regarding the zoogeographical characterization of the species (Abbreviations as in Table 1).

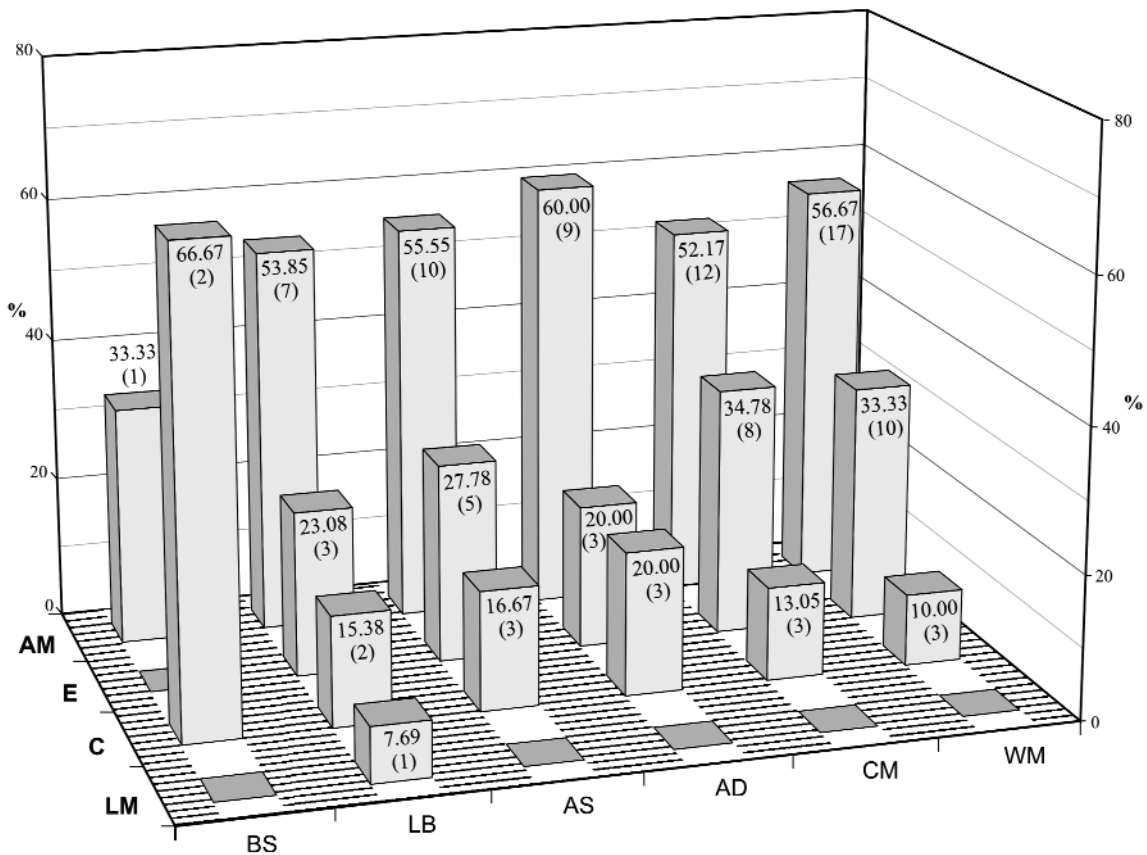


FIG. 7. Percentages of the four zoogeographical categories in the Mediterranean territorial and the Black Sea; calculations have been made for the total of species known from each area (Abbreviations as in Table 1).

ACKNOWLEDGMENTS

We would like to thank the two anonymous referees and the editor for their useful comments and suggestions that improved our manuscript.

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